

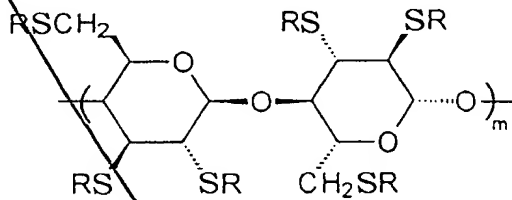
WHAT IS CLAIMED IS

1. A liquid crystal display device, comprising:

first and second substrates;

a first alignment layer on the first substrate,

wherein the first alignment layer includes



(spacer S is oxygen, m = 10~10,000),

the functional group R includes at least one of a group consisting of photo-sensitive constituents and non-photo-sensitive constituents, the photo-sensitive constituents include a material selected from the group consisting of cinnamoyl derivatives, the non-photo-sensitive constituents include a material selected from the group consisting of C<sub>n</sub>H<sub>2n</sub>, C<sub>n</sub>H<sub>2n+1</sub>, C<sub>n</sub>H<sub>2n</sub>OH, COC<sub>n</sub>H<sub>2n+1</sub>, COC<sub>n</sub>H<sub>2n</sub>, C<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>, C<sub>n</sub>H<sub>2n-(x-1)</sub>F<sub>(x-1)</sub>, C<sub>n</sub>H<sub>2n-x</sub>F<sub>x</sub>OH, COC<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub> (n = 1~10, x = 1~2n+1), and a combination thereof; and

a liquid crystal layer between the first and second substrate.

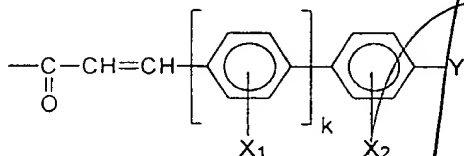
1 2. The liquid crystal display device according to claim  
2 1, further comprising a second alignment layer on the  
3 second substrate.

1 3. The liquid crystal display device according to claim  
2 2, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,  
6 polyamic acid and silicone dioxide.

1 4. The liquid crystal display device according to claim  
2 2, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

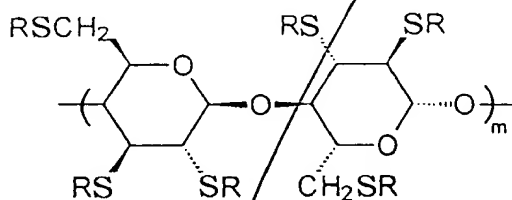
1 5. The liquid crystal display device according to claim  
2 1, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $\text{NO}_2$ ,  $\text{CH}_3$ ,  $\text{OCH}_3$ ,  $\text{CF}_3$ ,  $\text{OCF}_3$ ,  $\text{C}_n\text{H}_{2n+1}$ ,  
5  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_6\text{H}_5$ ,  $\text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1\sim 10$ ,  $x$   
6  $= 1\sim 2n+1$ ).

- 1 6. The liquid crystal display device according to claim  
2 1, wherein the cinnamoyl derivative is



- 3  
4 (X<sub>1</sub> and X<sub>2</sub> are each selected from the group consisting  
5 of hydrogen, fluorine, chlorine, CN, NO<sub>2</sub>, CH<sub>3</sub>, OCH<sub>3</sub>, CF<sub>3</sub>,  
6 OCF<sub>3</sub>; k is 0 to 1; Y is selected from the group consisting  
7 of hydrogen, fluorine, chlorine, cyano, NO<sub>2</sub>, CF<sub>3</sub>, OCF<sub>3</sub>,  
8 C<sub>n</sub>H<sub>2n+1</sub>, OC<sub>n</sub>H<sub>2n+1</sub>, C<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>, OC<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub> (n = 1~10, x =  
9 1~2n+1)).

- 1 7. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 a first alignment layer on the first substrate,  
4 wherein the first alignment layer includes



- 5  
6 (spacer S is sulfur, m = 10~10,000),  
7 the functional group R includes at least one of a  
8 group consisting of photo-sensitive constituents and non-  
9 photo-sensitive constituents; and  
10 a liquid crystal layer between the first and second

11 substrates.

1 8. The liquid crystal display device according to claim  
2 7, further comprising a second alignment layer on the  
3 second substrate.

4 9. The liquid crystal display device according to claim  
5 8, wherein the second alignment layer includes a material  
6 selected from the group consisting of a pyranose polymer,  
7 a furanose polymer, polyvinyl cinnamate, polysiloxane  
8 cinnamate, polyvinyl alcohol, polyamide, polyimide,  
9 polyamic acid and silicone dioxide.

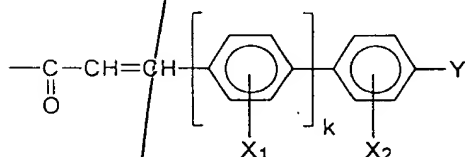
1 10. The liquid crystal display device according to claim  
2 8, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

1 11. The liquid crystal display device according to claim  
2 7, wherein the photo-sensitive constituent includes a  
3 material selected from the group consisting of cinnamoyl  
4 derivatives.

1 12. The liquid crystal display device according to claim  
2 7, wherein the non-photo-sensitive constituents include a  
3 material selected from the group consisting of H,  $C_nH_{2n}$ ,  
4  $C_nH_{2n+1}$ ,  $C_nH_{2n}OH$ ,  $COC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $C_nH_{2n-(x-1)}F_{(x-1)}$ ,  $C_nH_{2n-(x-1)}F_{(x-1)}OH$ ,  $COC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ), and a  
5 combination thereof.  
6

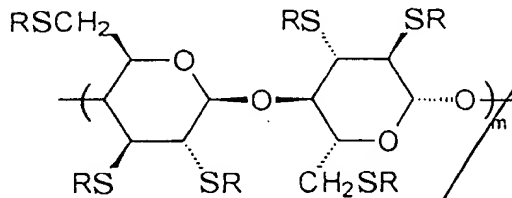
1 13. The liquid crystal display device according to claim  
2 11, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  $OCF_3$ ,  $C_nH_{2n+1}$ ,  
5  $OC_nH_{2n+1}$ ,  $C_6H_5$ ,  $C_6H_4OC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $OC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x$   
6  $= 1 \sim 2n+1$ ).

1 14. The liquid crystal display device according to claim  
2 11, wherein the cinnamoyl derivative is



3  
4 ( $X_1$  and  $X_2$  are each selected from the group consisting  
5 of hydrogen, fluorine, chlorine, CN,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  
6  $OCF_3$ ;  $k$  is 0 to 1;  $Y$  is selected from the group consisting  
7 of hydrogen, fluorine, chlorine, cyano,  $NO_2$ ,  $CF_3$ ,  $OCF_3$ ,  
8  $C_nH_{2n+1}$ ,  $OC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $OC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x =$   
9  $1 \sim 2n+1$ )).

1 15. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 a first alignment layer on the first substrate,  
4 wherein the first alignment layer includes



6 (spacer S is NH, m = 10~10,000),  
7 the functional group R includes at least one of a  
8 group consisting of photo-sensitive constituents and non-  
9 photo-sensitive constituents; and  
10 a liquid crystal layer between the first and second  
11 substrates.

1 16. The liquid crystal display device according to claim  
2 15, further comprising a second alignment layer on the  
3 second substrate.

1 17. The liquid crystal display device according to claim  
2 16, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,

6 polyamic acid and silicone dioxide.

1 18. The liquid crystal display device according to claim  
2 16, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

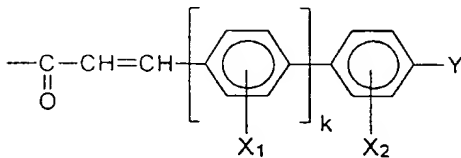
1 19. The liquid crystal display device according to claim  
2 15, wherein the photo-sensitive constituents include a  
3 material selected from the group consisting of cinnamoyl  
4 derivatives.

1 20. The liquid crystal display device according to claim  
2 15, wherein the non-photo-sensitive constituents include a  
3 material selected from the group consisting of H,  $C_nH_{2n}$ ,  
4  $C_nH_{2n+1}$ ,  $C_nH_{2n}OH$ ,  $COC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $C_nH_{2n-(x-1)}F_{(x-1)}$ ,  $C_nH_{2n-(x-1)}F_{x-1}OH$ ,  $COC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ), and a  
5 combination thereof.  
6

1 21. The liquid crystal display device according to claim  
2 19, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  $OCF_3$ ,  $C_nH_{2n+1}$ ,

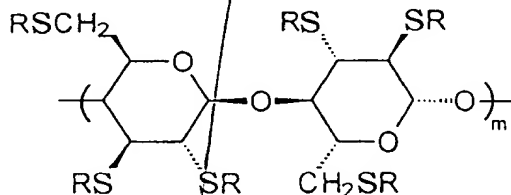
5  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_6\text{H}_5$ ,  $\text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1\sim 10$ ,  $x$   
6  $= 1\sim 2n+1$ ).

1 22. The liquid crystal display device according to claim  
2 19, wherein the cinnamoyl derivative is



5 ( $\text{X}_1$  and  $\text{X}_2$  are each selected from the group consisting  
6 of hydrogen, fluorine, chlorine,  $\text{CN}$ ,  $\text{NO}_2$ ,  $\text{CH}_3$ ,  $\text{OCH}_3$ ,  $\text{CF}_3$ ,  
7  $\text{OCF}_3$ ;  $k$  is 0 to 1;  $\text{Y}$  is selected from the group consisting  
8 of hydrogen, fluorine, chlorine, cyano,  $\text{NO}_2$ ,  $\text{CF}_3$ ,  $\text{OCF}_3$ ,  
9  $\text{C}_n\text{H}_{2n+1}$ ,  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1\sim 10$ ,  $x =$   
10  $1\sim 2n+1$ )).

1 23. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 a first alignment layer on the first substrate,  
4 wherein the first alignment layer includes



7 (spacer  $\text{S}$  is  $\text{OC}_h\text{H}_{2h}$  ( $h = 1\sim 5$ ),  $m = 10\sim 10,000$ ),  
the functional group  $\text{R}$  includes at least one of a



8 group consisting of photo-sensitive constituents and non-  
9 photo-sensitive constituents; and  
10 a liquid crystal layer between the first and second  
11 substrates.

1 24. The liquid crystal display device according to claim  
2 23,  
3 further comprising a second alignment layer on the  
4 second substrate.

1 25. The liquid crystal display device according to claim  
2 24, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,  
6 polyamic acid and silicone dioxide.

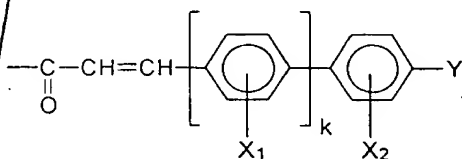
1 26. The liquid crystal display device according to claim  
2 24, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

1 27. The liquid crystal display device according to claim  
2 23, wherein the photo-sensitive constituents include a  
3 material selected from the group consisting of cinnamoyl  
4 derivatives.

1 28. The liquid crystal display device according to claim  
2 23, wherein the non-photo-sensitive constituents include a  
3 material selected from the group consisting of H,  $\text{OC}_n\text{H}_{2n}$ ,  
4  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{COC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n}\text{OH}$ ,  $\text{OC}_n\text{H}_{2n}\text{OH}$ ,  $\text{OCOC}_n\text{H}_{2n+1}$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$ ,  
5  $\text{OC}_n\text{H}_{2n-(x-1)}\text{F}_{(x-1)}$ ,  $\text{C}_n\text{H}_{2n-(x-1)}\text{F}_{(x-1)}\text{OH}$ ,  $\text{OC}_n\text{H}_{2n-(x-1)}\text{F}_{x-1}\text{OH}$ ,  $\text{COC}_n\text{H}_{2n+1-}$   
6  $x\text{F}_x$ ,  $\text{OCOC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ), and a combination  
7 thereof.

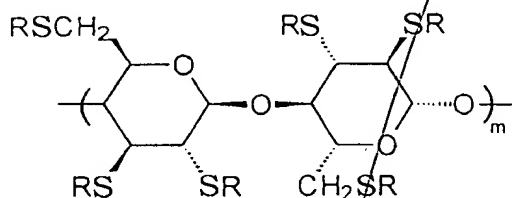
1 29. The liquid crystal display device according to claim  
2 27, wherein the cinnamoyl derivative includes at least one  
3 member selected from the group consisting of hydrogen,  
4 fluorine, chlorine, cyano,  $\text{NO}_2$ ,  $\text{CH}_3$ ,  $\text{OCH}_3$ ,  $\text{CF}_3$ ,  $\text{OCF}_3$ ,  $\text{C}_n\text{H}_{2n+1}$ ,  
5  $\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_6\text{H}_5$ ,  $\text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$ ,  $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$ ,  $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$  ( $n = 1 \sim 10$ ,  $x$   
6  $= 1 \sim 2n+1$ ).

1 30. The liquid crystal display device according to claim  
2 27, wherein the cinnamoyl derivative is



(X<sub>1</sub> and X<sub>2</sub> are each selected from the group consisting of hydrogen, fluorine, chlorine, CN, NO<sub>2</sub>, CH<sub>3</sub>, OCH<sub>3</sub>, CF<sub>3</sub>, OCF<sub>3</sub>; k is 0 to 1; Y is selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO<sub>2</sub>, CF<sub>3</sub>, OCF<sub>3</sub>, C<sub>n</sub>H<sub>2n+1</sub>, OC<sub>n</sub>H<sub>2n+1</sub>, C<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>, OC<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub> (n = 1~10, x = 1~2n+1)).

31. A liquid crystal display device, comprising:  
first and second substrates;  
a first alignment layer on the first substrate,  
wherein the first alignment layer includes



(spacer S is OC<sub>n</sub>H<sub>2n</sub>O (h = 1~5), m = 10~10,000),  
the functional group R includes at least one of a  
group consisting of photo-sensitive constituents and non-  
photo-sensitive constituents; and  
a liquid crystal layer between the first and second  
substrates.

32. The liquid crystal display device according to claim  
31,  
further comprising a second alignment layer on the

4 second substrate.

1 33. The liquid crystal display device according to claim  
2 32, wherein the second alignment layer includes a material  
3 selected from the group consisting of a pyranose polymer,  
4 a furanose polymer, polyvinyl cinnamate, polysiloxane  
5 cinnamate, polyvinyl alcohol, polyamide, polyimide,  
6 polyamic acid and silicone dioxide.

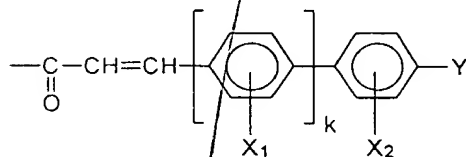
1 34. The liquid crystal display device according to claim  
2 32, wherein at least one of the first and second alignment  
3 layers is divided into at least two domains for driving  
4 liquid crystal molecules in the liquid crystal layer  
5 differently on each domain.

1 35. The liquid crystal display device according to claim  
2 31, wherein the photo-sensitive constituents include a  
3 material selected from the group consisting of cinnamoyl  
4 derivatives.

36. The liquid crystal display device according to claim 31, wherein the non-photo-sensitive constituents include a material selected from the group consisting of  $H$ ,  $C_nH_{2n}$ ,  $C_nH_{2n+1}$ ,  $C_nH_{2n}OH$ ,  $COC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $C_nH_{2n-(x-1)}F_{(x-1)}$ ,  $C_nH_{2n-(x-1)}F_{x-1}OH$ ,  $COC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ), and a combination thereof.

37. The liquid crystal display device according to claim 35, wherein the cinnamoyl derivative includes at least one member selected from the group consisting of hydrogen, fluorine, chlorine, cyano,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  $OCF_3$ ,  $C_nH_{2n+1}$ ,  $OC_nH_{2n+1}$ ,  $C_6H_5$ ,  $C_6H_4OC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $OC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ ).

38. The liquid crystal display device according to claim 35, wherein the cinnamoyl derivative is



( $X_1$  and  $X_2$  are each selected from the group consisting of hydrogen, fluorine, chlorine,  $CN$ ,  $NO_2$ ,  $CH_3$ ,  $OCH_3$ ,  $CF_3$ ,  $OCF_3$ ;  $k$  is 0 to 1;  $Y$  is selected from the group consisting of hydrogen, fluorine, chlorine, cyano,  $NO_2$ ,  $CF_3$ ,  $OCF_3$ ,  $C_nH_{2n+1}$ ,  $OC_nH_{2n+1}$ ,  $C_nH_{2n+1-x}F_x$ ,  $OC_nH_{2n+1-x}F_x$  ( $n = 1 \sim 10$ ,  $x = 1 \sim 2n+1$ )).

1 39. A liquid crystal display device, comprising:  
2 first and second substrates;  
3 an alignment layer on the first substrate, wherein  
4 the alignment layer includes a cellulose, a derivative of  
5 a cinnamoyl group and a spacer between a main polymer  
6 chain and the derivative of the cinnamoyl group; and  
7 a liquid crystal layer between the first and second  
8 substrates.

1 40. The liquid crystal display device according to claim  
2 39, wherein the derivative of the cinnamoyl group includes  
3 at least one member selected from the group consisting of  
4 hydrogen, fluorine, chlorine, cyano, NO<sub>2</sub>, CH<sub>3</sub>, OCH<sub>3</sub>, CF<sub>3</sub>,  
5 OCF<sub>3</sub>, C<sub>n</sub>H<sub>2n+1</sub>, OC<sub>n</sub>H<sub>2n+1</sub>, C<sub>6</sub>H<sub>5</sub>, C<sub>6</sub>H<sub>4</sub>OC<sub>n</sub>H<sub>2n+1</sub>, C<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>, OC<sub>n</sub>H<sub>2n+1-x</sub>F<sub>x</sub>  
6 (n = 1~10, x = 1~2n+1).

1 41. The liquid crystal display device according to claim  
2 39, wherein the spacer includes at least one member  
3 selected from the group consisting of oxygen, sulfur, NH,  
4 OC<sub>n</sub>H<sub>2h</sub>, OC<sub>n</sub>H<sub>2h</sub>O (h = 1~5).

1 42. The liquid crystal display device according to claim  
2 39, wherein the alignment layer is divided into at least  
3 two domains to drive differently liquid crystal molecules

4 in the liquid crystal layer on each domain.

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